The Blockchains Technologies for Cryptocurrencies: A Review

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Abstract— **A blockchain is a decentralized architecture that most cryptocurrencies rely on duplicating and distributing a digital ledger of transactions across a peer-to-peer network with built in security to increase the trust and integrity of the transactions. Due the benefits of this technology, we review Recently published papers to explain its main types (public, private, hybrid) and extract the main characteristics of each one separately to know what is the suitable type depended on environment conditions and predefined requirements. and review of the popular cryptocurrencies working environments, which are generally considered one of the basic applications depended on the blockchain.**

Keywords—*Blockchain Types, Cryptocurrency, Bitcoin, Ethereum, Litecoin.*

I. INTRODUCTION

The peer-to-peer (p2p) data storage provided by blockchain technology is trustless, secure, and decentralized. There are blocks of information contained in the blockchain network that are linked together in a sequential manner. With the aid of hash function linkages, each subsequent block is permanently linked to the one before it [1]. In order to tackle the problem of traditional distributed database synchronization using a distributed consensus algorithm, blockchain technology combines cryptography, mathematics, algorithms, and economic model, it is an integrated multi-field infrastructure development [2]. Cryptocurrency may be utilized as a fuel for the global money transfer network because it is a blockchain-based currency and its main application. It has emerged since 2009 and a variety of cryptocurrencies have been launched to meet various requirements and accomplish different purposes [3]. Depending on the data that can be accessed, blockchains can be classified into three main types: public, private and hybrid. Everyone has access to the data stored on a public blockchain. The private blockchain, on the other hand, only allows access to approved parties or users. As the name suggests, the hybrid blockchain is a system that combines the best features of both public and private blockchains [4].

A theoretical background of blockchains and cryptocurrencies concept is to be presented in the first section. In the second section, a review of blockchain types and the popular cryptocurrencies are to be presented respectively, additionally we present the main characteristics extractions and discussions.

II. BLOCKCHAIN CONCEPT

Under the Pseudonym Satoshi Nakamoto, a landmark paper entitled "Bitcoin: A Peer-to-peer Electronic Cash System" was written in 2008. The word blockchains was formulated as a technology that refers to an immutable, peer-to-peer, distributed ledger that is cryptographically secure, append-only, and updated only by consensus or agreement among peers [5]. Blockchain enables transactions to be completed in a transparent, timely, cost-effective, irreversible manner[6], and it produces a unit of account that does not require centralized tracking. Instead, the blockchain uses cryptographic mathematical trust to keep track of digital transactions. The network is simple because it uses a peer-to-peer approach to validate and publish these blocks, it requires a distributed data structure for backup and recovery and protocols that makes up an internet public network[7]. Each block in the chain is a logical grouping of transactions; a transaction is a record of an occurrence, like transferring money from one account to another. A block is made up of transactions and varies in size based on the blockchain used [5].

A blockchain is a dynamic document. As time passes, more transactions are added. With PayPal, users trust that the central authority will continually update its ledger with new transactions. There is no central authority in a decentralized payment network like Bitcoin, only thousands of anonymous miners. So who should users trust to add new transactions to Bitcoin's blockchain? Consensus is achieved by gaining trust, it is a method used by all network miners to decide who gets to add a block of validation transactions [7].

III. CRYPTOCURRENCY

Cryptocurrency is a type of virtual currency that is based on mathematics and is decentralized, convertible and protected by cryptography. Bitcoin, created by Satoshi Nakamoto in 2009, was the first who introduced cryptocurrency [6]. It is like many other emergent technologies; it has heralded the arrival of a new way of thinking-in this case, about finance. The issue is that novel approaches to storing value are being developed. Cryptocurrency bears certain resemblances to fiat money, stocks, and bonds, as well as to commodities such as gold, and these similarities are important. In contrast to other assets, the processes of purchasing and transferring cryptocurrency, or crypto, are fundamentally different from other valuables such as gold or silver [7]. The underlying blockchain technology of cryptocurrency provides a transparent and decentralized

ledger to record the transactions of the cryptocurrencies, however, the trust of the users is no longer based on any central authority thanks to the decentralization of cryptocurrency. As a result, hackers can construct fraudulent transactions in the negative voids left by the system. Users' trust has been damaged as a result [6]. Bitcoin was the first cryptocurrency to successfully solve the problem of distributed consensus on a trustless network. A proof of work (POW) mechanism was utilized in conjunction with public key cryptography to provide a safe, controllable, and decentralized method of minting digital currency for the Bitcoin network. The idea of an ordered list of blocks made of transactions and cryptographically safeguarded by the POW process was a significant invention in the cryptocurrency space [5].

IV. RESEARCH METHODOLOGY

The methodology of this paper includes a review of blockchains technologies types that participate in built of cryptocurrencies and extract the main characteristics of each type in order to know what is the appropriate technology to choose based on the pre-defined requirements. We have collected many research papers from different well-known sites such as Google Scholar, Researchgate, Scopus, IEEE, etc. In order to accomplish the review of the blockchain technologies, three classified sections depending on blockchains types (public, private, and hybrid) were adopted and blockchains nature related to popular cryptocurrencies.

V. LITERATURE REVIEW

A. Blockchain Types

In general, a blockchain is a chain of records that are connected together through cryptography. Each block in the sequence has a reference to the block immediately preceding it, referred to as the parent block. The genesis block is the initial block in a blockchain and has no parent block [4]. Public, Private, and Hybrid blockchains are the most common types [8]. This sub section provides a review of several researches to explain these types and extract their main characteristics.

a. Public Blockchain

Due to the open nature of the blockchain, anyone can transact on the network. A public blockchain achieves decentralization. The system is based on user consensus and has no single point of failure. However, the public blockchain is susceptible to system attacks. For example, an attacker could reassemble and link all modified blocks without the participants knowing [8].

Sabry et al. Classified blockchains types by their system architecture and consensus strategy. Referring to a public blockchain, they involved Bitcoin is the first implementation of a distributed ledger technology and it supports mining process, the development of Bitcoin was solely motivated by the need to address the issue of duplicate digital money spending in the Bitcoin network, consumers request transactions, while miners add new blocks to the main blockchain [9]. Shrivas et al. made the classification based on an authorization participation, on the public blockchain that is unrestricted so anyone can join the blockchain network and participate in the verification process and everyone can examine and verify the transaction to reach the consensus.

Bitcoin and Ethereum are examples of public blockchain [10]. Okada et al. applied the classification depending on the incentive between the participants, if a Bitcoin miner succeeds in creating a new block, they are rewarded with a new Bitcoin as a fee for their contribution to the system's survival, although miners do receive transaction fees as part of the package [11].

Tang et al. Explained it as follows: with any other platform or system, the blockchain's popularity is an important factor in evaluating its performance, an example has been given of the second global public blockchain technology assessment index which places Bitcoin to be the seventeenth, yet it is still one of the most popularity [12].

b. Private Blockchain

To engage in a private blockchain, only limited number of users (nodes in the blockchain network) are allowed to send new transactions and participate in the network [1]. This type of blockchain relies on member ids, and can use traditional byzantine fault tolerant consensus [9]. Pahlajani et al. helped the researchers to select suitable consensus in private blockchain: consensus algorithms are a way for a group of nodes to come to a decision together, it is a decision where nodes must help the majority, regardless of individual choice. They talked about the many voting-based consensus methods that are employed in private blockchain, making it easier to select the consensus based on business requirements, with a direct impact based on its performance [13]. Dinh et al. and Lin et al. Explained the hyper ledger as an example of private blockchain, started by the Linux foundation in December 2015, it is focused on ledgers designed to support global business transactions, including major technological, financial, and supply chain companies, with the goal of improving many aspects of performance and reliability [14] [15]. Hao et al. mentioned that the private blockchain uses PBFT in consensus process, in which up to one-third of harmful byzantine duplicates could be eliminated [16].

Yang et al. Gave an example to apply the private blockchain so when banks want similar protocols to protect their transfers. In this circumstance, they must establish their own private blockchain, there are 25 worldwide banks who have gathered behind a fintech blockchain in this case [17]. Zheng et al. Made the comparison of consensus process across different blockchains, so a private blockchain is totally controlled by one organization, which can decide the final consensus while in public chain, any node can participate to consensus. As far as the immutability is concerned, a public blockchain is nearly impossible to alter with because records are kept on by many participants. Unlike a public blockchain, a private blockchain can be easily manipulated with and it could be more efficient than public blockchain because of fewer validators [18]. Golosova et al. explained the key benefit of this type of Blockchain due to the smaller pre-selected participants, the private blockchain can scale computing easily if the transaction count is increased [20]. Monrat et al. presented an analysis of permissioned blockchain technologies such as Ethereum, quorum, corda, and hyperledger. The scalability of these platforms is measured by expanding the network size (nodes) and increasing the deployed concurrent transactions. Overall, hyperledger fabric outperforms alternative permissioned platforms in terms of throughput and latency [21].

c. Hybrid Blockchain

It is a system design that mixes distributed blockchains with centralized servers. Authentication and security will be provided by personal blockchains connecting users to servers. This reduces end-user storage needs and increases network scalability. This proposed structure creates a reliable scalable business model [22]. Haque et al. Provided a survey of some characteristics of many blockchain types, where it is possible that some parts of the network will be open to the general public, while others would be restricted to authenticated individuals, hybrid blockchain refers to this combination of a public and a private blockchain, for example: there are two blockchains, the centralized home chain and the decentralized public network, with a global Ledger and public chain based on proof-of-work, smart cities can hypothetically connect via centralized home chains and ledgers. Dragon chain is a famous hybrid blockchain platform [23]. Kim et al mentioned that there are trade-offs in hybrid blockchain to allow a codebase to be used on both private and public networks, provide apps, tools, and customized development, or to allow interoperability between diverse codebases [24]. Desai et al. provided a hybrid blockchain model to conduct private and transparent auctions. To ensure that only the auctioneer has access to the bids, a private chain has been designed. Additionally, a public chain is used to publicize the winning bidders in auctions [25].

B. The Three Popular Cryptocurrencies

Since the introduction of Bitcoin and blockchain technology has been referred to as a cryptocurrency platform, decentralized ledgers can be created by moving from single-party centralized ledgers to distributed ledgers with multiple nodes confirming each other's transactions. Decentralization and solid security make blockchain an ideal platform for a wide range of applications, especially in cryptocurrencies fields [4]. To put it simply, a blockchain is a collection of immutable records with timestamps maintained by a group of machines that are not owned by a single entity. Blockchains can take many forms: cryptographic principles safeguard and link each of these data blocks [31]. we collect many researches to review the working environments of three popular cryptocurrencies: Bitcoin (BTC), Ethereum (ETH) and Litecoin (LTC).

a. Bitcoin

In the last several years, the amount of Bitcoin researches has increased significantly. Instead of centralized validation, blockchain introduced the concept of distributed consensus-based validation. First introduced by Nakamoto (2009), the beginning of using the cryptocurrency is to create a new type of payment system that functions in parallel to the existing financial system. Bitcoin has grown significantly as an investment and speculative tool since its inception [32]. Urquhart used Google trends to find out what is attracting the most attention to Bitcoin; it was discovered that Bitcoin's volatility and volume are major attention-getters [33]. Corbet determined the early assessments of Bitcoin: it was not the money, the means of exchange, neither the unit of account and a store of wealth, where the Bitcoin failed to live up to expectations, assuming that Bitcoin has no inherent worth [34]. Bauret et al. mentioned that because of its extreme volatility, Bitcoin is not usable as a medium of exchange [35]. Maram described the generation of Bitcoin as the miner earns Bitcoins by solving a block's puzzle and Every Bitcoin

transaction on the blockchain network is visible to all users. Because every block on the blockchain network is validated by a different user, it cannot be changed. This marks the beginning of a new era in digital transaction security [36]. Fullmer et al. described the proof of work that is required for Bitcoin. You can think of this as a solution to a mathematical puzzle that relies on the candidate block's data, the goal of proof of work is to ensure the blockchain's immutability. It takes a long time for each node to verify the transaction and perform proof of work [37] and Paulet al. Mentioned that the Transactions in public systems occur at a rate of seven (07) per second and consumes high energy [28].

b. Ethereum

Ethereum is a blockchain-based platform for smart contracts that emerged in 2015 with its own cryptocurrency [38]. Ethereum's smart contracts may be used for a wide variety of purposes, allowing for a more diverse range of applications and the smart contracts may be used to operate many apps that would normally require a web server [39]. Vujičić et al. Mentioned the main differences between Ethereum and Bitcoin: unlike Bitcoin blocks, which contain simply the block number, difficulty and nonce, Ethereum blocks also include the transaction list and current state, the new states are formed by applying the previous state to each transaction in the transaction list [40]. Oliva et al. Explained the smart contract as a piece of computer code and a computerized process for transacting in accordance with a contract's conditions, the concept of "smart contracts" has evolved much broader since the rise of Ethereum and other advanced blockchain systems, encompassing any computation. Smart contracts can be hosted on Ethereum and they can also be executed. When compared to mobile app stores, which just host applications, this is a major difference [41]. Also Vujičić et al. Mentioned that the Ethereum is described as a turning-complete blockchain, because it is abstract, anyone can build their own ownership rules, transaction formats, and state transition mechanisms. Smart contracts, a collection of cryptographic rules that are only performed if specific criteria are met, are used [40]. Liu et al. described the Ethereum's architecture where it is composed from five layers (data, network, consensus, incentive, and smart contract) [42].

c. Litecoin

While Bitcoin is now the most widely accepted currency, Litecoin is seen as a strong challenger for the currency. Litecoin was designed to execute smaller value transactions quickly in the month of October of 2011 by Charles Lee [43]. Jumaili and Karim made the comparisons between Bitcoin and Litecoin: as a substitute for Bitcoin, Litecoin was regarded a silver currency, whereas Bitcoin was deemed gold. While Litecoin can be mined on a normal desktop computer with less processing power, Bitcoin mining requires a powerful machine with a lot of processing power. Although Litecoin transactions take only 2.5 minutes to process compared to 10 minutes for Bitcoin transactions. There are currently around 84 million Litecoin in circulation [44]. Miglietti et al. provided the analysis of volatility related to Litecoin, Bitcoin, and Euro, where Litecoin has a higher volatility than Bitcoin and the Euro, and Bitcoin has a higher volatility than the Euro, when calculated through financial information data from 2010 to 2015 and compared to other asset categories like as bonds and gold [45]. Jumaili and Karim showed that technically identical to Bitcoin, Litecoin has almost no transaction fees and has

higher four times than speed of Bitcoin payments. As a result, it has the largest market cap and is the simplest. On May 1, 2013, Litecoin's price and market value stood at 73.9 million, and its price was more raised in December 19, 2017. Charlie Lee aspired to improvement, where he developed new sets of rules known as "scripts". Because it uses less electricity and mining with the simple software, it is four times faster than mining with SHA-256a new block of transactions is uploaded to the Litecoin Blockchain in less than a minute [44].

VI. CHARACTERISTICS EXTRACTION AND DISCUSSIONS

After we review many papers to describe the main blockchain types and three cryptocurrencies in previous section, Table I lists some main characteristics that distinguish the types of blockchain from each other and they are explained in Table. II.

TABLE I.   THE MAIN CHARACTERISTICS OF THE BLOCKCHAIN TYPES

Characteristics	Blockchain Types		
	Public	*Private*	*Hybrid*
Openness	✓		
Transparency	✓		
Accessible	✓		
Verification	✓		
Privacy		✓	
Flexible	✓		
Trust		✓	
Low consumption of power		✓	
A lot of output		✓	
User authentication		✓	
Scalability		✓	
Speed		✓	
Combining the best features			✓

TABLE II.   EXPLANATION THE BLOCKCHAIN TYPES CHARACTERISTICS

Blockchain Types		
Public	*Private*	*Hybrid*
It's opens for everyone, total distributed, unlike other types [26].	The central authority such as a private blockchain can provides a high privacy level (guarantee of personal privacy)[29].	It combines the best features of both public and private blockchains [25].
It has total transparency for all participates unlike other types [1].	The data is only known to the trusted parties and they are pre-selected instead of the general public [30].	
Anyone can easily gain access to the computer network unlike other types [2].	It consumes low power, unlike public blockchain consumes a lot more electricity due to the proof of work requirements [28].	
It's enables anyone to verify the system's current condition, unlike other types [3] .	It depends on the certificates of participation to enhance the user authentication [9].	
It's a free with no rules or regulations [28].	It required for the smaller pre-selected users, so the scalability of these categories of the Blockchain is the key advantage [20].	
An environment that is both open and flexible [28].	It has a much faster speed than public blockchain [19], because the limited number of participates and has a lot of output unlike the public chain, Due to the massive number of nodes and vast network, the transaction rate per second is extremely low[28].	

As it reviewed of the main characteristics in the Table II, the public blockchain has ease and flexibility when joining it as a new user and correspond to a high degree of transparency such as the Bitcoin network, which is available without restrictions and in such a type it is chosen when designing an open model without restrictions, for example building a new cryptocurrency It has similar characteristics to Bitcoin and at the same time, it works to address some things, for example, reduce the block time or increase the throughput. But when designing a structure affiliated to a particular institution with a high degree of privacy, security and restriction for a group of individuals, the private blockchain is chosen, for example, when designing a blockchain for a bank or university in order to facilitate the management process through a distributed network restricted to a group of people. But when building a blockchain belonging to a particular organization and at the same time, it has the ability to connect to other blockchains, here a hybrid blockchain is chosen that combines the characteristics of private and public blockchains and works to take the advantages of each type, for example, it has a high degree of privacy so that it relates to a group of individuals and in at the same time, it works to receive the transactions from outside blockchains.

About the three cryptocurrencies (BTC, LTC, ETH), Fang et al. described them as the three main cryptocurrencies, where they presented a comprehensive analysis of the market cap from January 2017 to December 2021, as the largest values were for Bitcoin and Ethereum. Among the studies reviewed in this paper, the volatility of six largest cryptocurrencies were checked from August 2015 to February 2018, where they found the most influential on the other cryptocurrencies are Bitcoin and Litecoin [31]. After we reviewed in previous section, the Table III lists some main differences between these three cryptocurrencies. Additionally, in the Fig. 1, Fig. 2 and Fig. 3, we reviewed a price analysis of them depended on Trading View site against the US dollar from February 24 to April 9 2022.

TABLE III.   DIFFERNCES BETWEEN BITCOIN, ETHEREM AND LITECOIN.

	Cryptocurrencies types		
	Bitcoin	*Ethereum*	*Litecoin*
Founder	Satoshi Nakamoto	Vitalik Buterin	Charles Lee
Release Time	2009	2013	2011
Platform type	Public	Public/ private	Public
Design Vision	Virtual Currency	Smart contract and decentralized applications	Virtual Currency

Maximum Coins	21 million	No limit	84 million
Consensus	POW	GHOST protocol	Scrypt
Block time	10 min	10–19 s	2.5 min
Block size Limit	8 MB	No limit	1 MB

Fig. 1.   Bitcoin (BTC) price analyses.
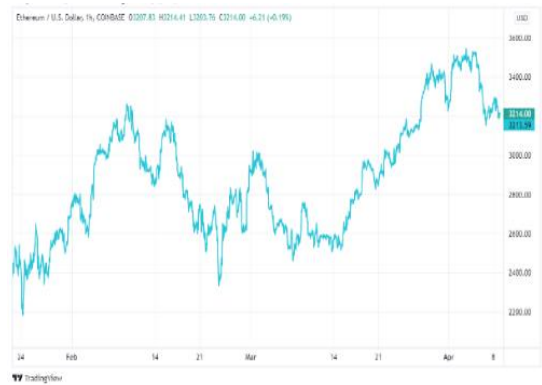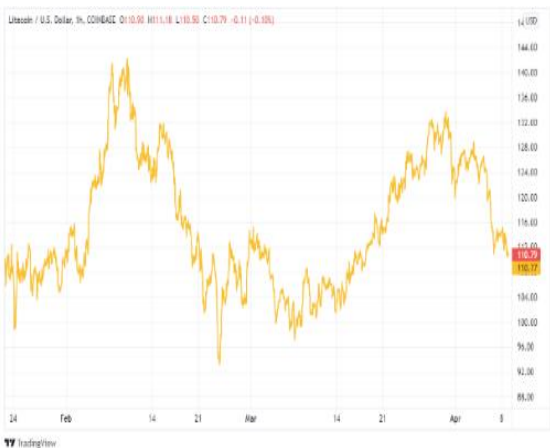

Fig. 2.   Ethereum (ETH) price analyses.

Fig. 3.   Litecoin (LTC) price analyses.

Source: http://www.tradingview.com

VII.   CONCLUSION AND FUTURE WORKS

After what is reviewed in previous researches, they were recently published during the period from 2017 to 2022 from famous sites, In order to clarify each type of blockchain separately, for example: their general structures, consensus algorithms, network size, restriction degree, main characteristics etc., we find it necessary to choose the appropriate type of blockchain, based on the pre-defined requirements as well as according to the required work environment and the conditions capable of it when building a new cryptocurrency or designing a model based on blockchains. Therefore, the gist of this paper was to highlight the characteristics that distinguish each type of blockchains from another and to know the nature of each one as well as its advantages and disadvantages. We also presented information about blockchains nature belong to three popular cryptocurrencies (BTC, LTC, ETH), where we have seen the nature of the work of each one separately, and there are also similarities between them. But as for the differences, they are improvements made to the history of cryptocurrencies in order to design a cryptocurrency that addresses one or more specific problems found in an existing currency. In the future, we aim to design a new cryptocurrency with a recommendation to study the surrounding requirements in order to choose an appropriate type of blockchains.

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